BONNEVILLE POWER ADMINISTRATION

Johnson Creek Artificial Propagation Enhancement Project Operations and Maintenance Program

2003 Johnson Creek Adult Chinook Salmon Report Run

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JOHNSON CREEK ARTIFICIAL PROPAGATION ENHANCEMENT PROJECT
OPERATIONS AND MAINTENANCE PROGRAM

2003 JOHNSON CREEK
ADULT CHINOOK SALMON RUN REPORT

Period Covered: June 2003 through December 2003

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ABSTRACT

The Nez Perce Tribe, through funding provided by the Bonneville Power Administration, has implemented a small scale chinook salmon supplementation program on Johnson Creek, a tributary in the South Fork of the Salmon River, Idaho. The Johnson Creek Artificial Propagation Enhancement project was established to enhance the number of threatened Snake River spring/summer chinook salmon (*Oncorhynchus tshawytscha*) returning to Johnson Creek to spawn through artificial propagation.

This was the fifth season of adult chinook broodstock collection in Johnson Creek following collections in 1998, 2000, 2001, and 2002. Weir installation was completed on June 26th with the first chinook captured on June 28 and the last fish captured on September 11th. The weir was removed on September 15th. A total of 784 adult chinook, including jacks, were captured during the season. Of these, 606 were natural, 165 were hatchery origin Johnson Creek supplementation fish, and 13 were adipose fin clipped fish from other hatchery operations and therefore strays into Johnson Creek. Over the course of the run, 79 natural origin Johnson Creek adult chinook were retained for broodstock, transported to the South Fork Salmon River adult holding and spawning facility and held until spawned. The remaining natural origin Johnson Creek fish along with all the Johnson Creek supplementation fish were released upstream of the weir to spawn naturally. Twenty-five Johnson Creek females were artificially spawned with 28 Johnson Creek males. No females were diagnosed with high bacterial kidney disease levels so no eggs were destroyed. The 25 females produced 126,900 green eggs with an average eye-up rate of 80.4% for 101,960 eyed eggs. The eggs will be incubated and reared at the McCall Fish Hatchery until the juvenile smolt stage and then released back into Johnson Creek in late March 2005.

ACKNOWLEDGEMENTS

The Johnson Creek Artificial Propagation Enhancement Project would like to thank all of the people and Agencies that contributed to the success of this project. Dave Johnson, Ed Larson, Becky Ashe, Doug Nelson, Carl East, Sarah Aavedal, Ryan Jain, JR Inglis, Rick Orme, and Jason Vogel from the Nez Perce Tribe; Ken Kirkman from the Bonneville Power Administration, which provided the funding for this project; the Northwest Power Planning Council; Dan Herrig and his staff at the USFWS, Lower Snake Compensation Office; Gene McPherson and his staff at the McCall Fish Hatchery, who do most of the rearing of the JCAPE fish; Rodney Duke and his crews for CWT and VIE tagging; Herb Pollard from the National Marine Fisheries Service; Doug Munson, Doug Burton, and Tom Rogers from Idaho Fish and Game; and the many other individuals whom we cannot remember at this time that assisted on this project either directly or indirectly.

INTRODUCTION

This report details the results from the brood year (BY) 2003 adult summer chinook salmon (*Oncorhynchus tshawytscha*) trapping, holding, spawning, and incubation through eye-up activities associated with the Johnson Creek Artificial Propagation Enhancement (JCAPE) project's Operations and Maintenance (O&M) program. Monitoring and Evaluation (M&E) activities associated with the JCAPE project for the 2003 adult brood year are detailed in a separate report. The JCAPE project is managed by the Nez Perce Tribe's (NPT) Department of Fisheries Resource Management (DFRM) and funded by the Bonneville Power Administration.

BACKGROUND

The Johnson Creek summer chinook salmon population has experienced significant decline in population numbers over the past five decades. Escapement levels in Johnson Creek have declined from a recorded high of 486 redds in 1960 to a low of five redds observed in 1995. Due to critically low abundance of summer chinook salmon in Johnson Creek, the Nez Perce Tribe (NPT), through funding provided by the Bonneville Power Administration (BPA), initiated the development of an artificial propagation enhancement project for Johnson Creek in 1996. This decision resulted from a number of factors including: increased emphasis on wild/natural production and stock recovery; consultation and requirements resulting from listing of Snake River chinook populations as threatened under the ESA; and preferred strategies for use of artificial propagation identified in *Wy-Kan-Ush-Mi Wa-Kish-Wit, Spirit of the Salmon* (CRITFC 1995).

The Nez Perce Tribe, as the lead fisheries management agency for the JCAPE project, submitted an Endangered Species Act (ESA) Section 10 Permit Application (Lothrop 2000) to the National Oceanic and Atmospheric Administration (NOAA Fisheries), formerly known as National Marine Fisheries Service (NMFS), for the purpose of supplementing the Johnson Creek chinook salmon population. NOAA gave approval for the JCAPE project to capture returning adult salmon in Johnson Creek for the purpose of broodstock collection and subsequent rearing and release of their progeny back into Johnson Creek. The JCAPE project is allowed to rear up to 100,000 smolts per year through this approval.

An annual agreement with the United States Fish and Wildlife Service, Lower Snake River Compensation Plan Office (LSRCP) and the Idaho Department of Fish and Game (IDFG), McCall Fish Hatchery allocates space for the JCAPE project to rear up to 100,000 Johnson Creek smolts at the existing McCall Fish Hatchery. In addition, the JCAPE project holds and spawns Johnson Creek adult broodstock at the South Fork Salmon River (SFSR) adult trapping and spawning facility that is associated with the McCall Fish Hatchery.

DESCRIPTION OF PROJECT AREA

Johnson Creek headwaters are near Deadwood Summit at an elevation of about 7,200 feet and flows northward approximately 35 miles to its confluence with the East Fork South Fork Salmon River near the community of Yellowpine at an elevation of 4,500 feet (Figure 1). Elevations range from 4,500 to 8,500 feet. The subbasin area is 153,800 acres, primarily National Forest land with some private in holdings. Over half of the sub-basin is inventoried roadless area. The predominant vegetation is mixed conifer forest with interspersed grass and sedge meadows. The upper one-third of the Johnson Creek subbasin has extensive meadow areas, the middle one-third is characterized by steep cascading sections, and the lower one-third of the sub-basin is lower gradient and located in a wide-bottomed valley. Most of the historic and current chinook salmon spawning and rearing has been observed in this lower section (NOAA Fisheries 2004 draft). Runoff is characterized by high flows in the spring followed by a decreasing hydrograph with the lowest flows typically in early fall through late winter. Mean annual precipitation varies from between 15 and 58 inches. Most of this precipitation falls in the form of snow from October through April. Summer temperatures can reach near 100 at the lowest elevations, while winter lows are often well below zero (USFS 1995, USFS 1990).

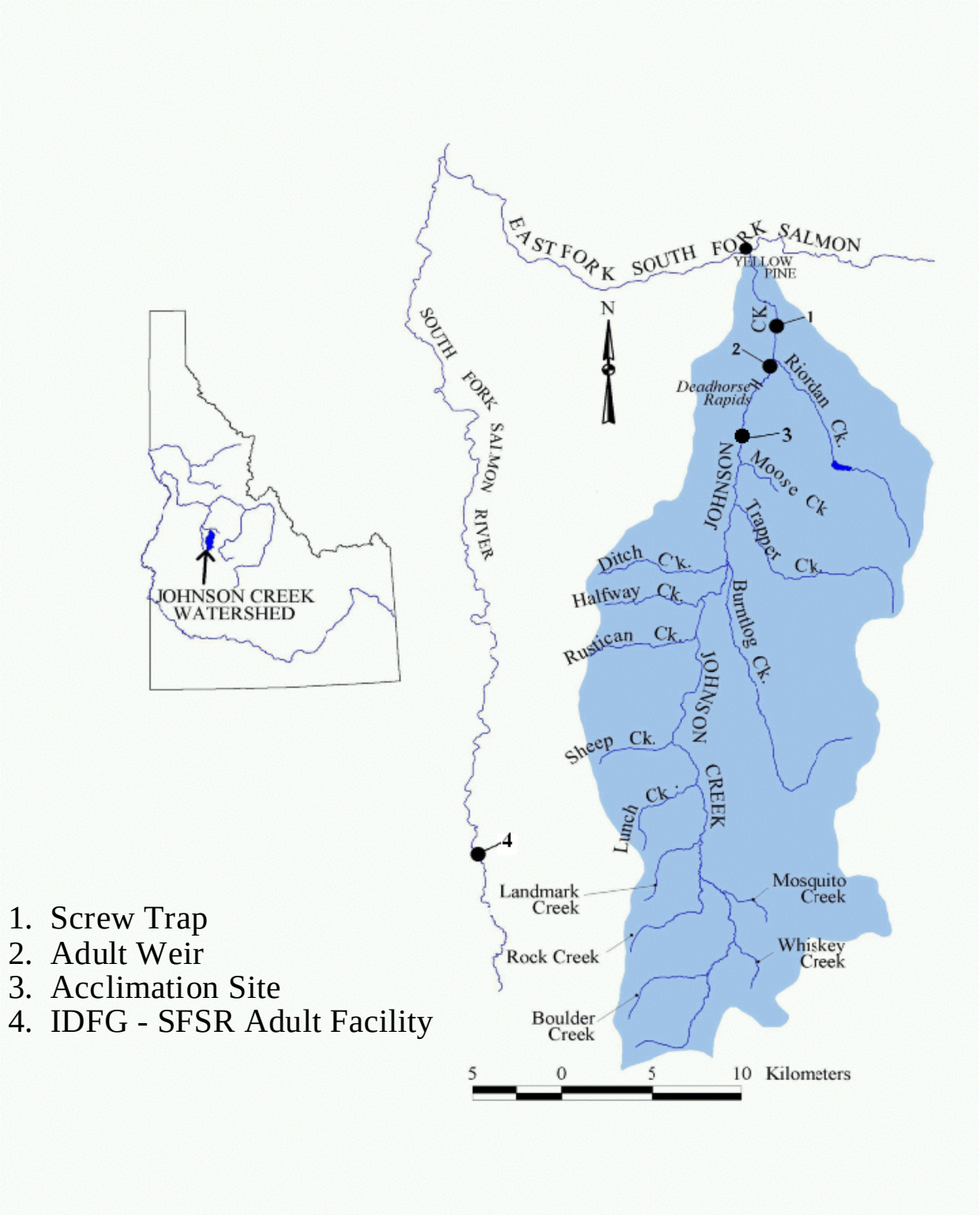

Figure 1: Map of Johnson Creek Watershed and JCAPE Sites

ADULT ESCAPEMENT AND TAKE ESTIMATES

The Johnson Creek Artificial Propagation Enhancement (JCAPE) project can rear up to 100,000 Johnson Creek smolts at the McCall Fish Hatchery (MFH). This level of production requires eggs from approximately 32 females. The NOAA Fisheries take permit allows up to 40 males and 40 females to be collected and retained for broodstock. Broodstock for the JCAPE program is collected over the spectrum of the adult run and across all age classes. In order to prevent biasing one age class or portion of the run, it is necessary to set an adult take level that will meet broodstock and natural spawning needs. This is best done using an adult escapement estimate to set the percentage of fish to be retained as broodstock.

In 2003, the adult escapement estimate was based on the number of redds from 1999 and an extrapolation of the number of natural age 4 fish that returned in 2002. Adult escapement to Johnson Creek in 2003 was estimated to be about 750 natural origin fish. Assuming an equal sex ratio for the number of returning adults, it was determined that one out of every 10 natural origin adults, by age and sex, would be retained and transported to SFSR adult holding facility for artificial propagation purposes.

ADULT TRAPPING

Adult trapping activities occurred in Johnson Creek approximately five miles above the confluence of the East Fork of the South Fork of the Salmon River (Figure 1). This is the same location used in prior years. The weir was located on privately owned property of the Bryant Ranch, and was used in agreement with the owners of the property. The Bryant Ranch is located on both sides of Johnson Creek.

The Johnson Creek weir is a temporary picket weir consisting of an in-stream trap box with wings that angle downstream to either shore. The weir wings block upstream passage of adult chinook salmon and funnel them into the trap box. The trap box is an aluminum framework filled with the same style of pickets used in the weir wings. The dimensions of the trap box are approximately 8'x 8'x 8'. The plywood trap box cover previously used for shade and a jump barrier was replaced with a woven fabric barrier that is less harmful to the fish.

The weir was installed as soon as water flows allow. Based on past experience, JCAPE personnel determined that 700 cfs is the maximum flow allowing for safe and efficient weir installation. Average water year conditions were observed in 2003 and the weir was installed on June 26 at 645cfs.

A downstream trap box was installed on the west side guide fence to trap downstream migrating fish. This trap box was constructed of the same materials as the upstream trap box but was 4' x 4' x 8'. Species other than adult chinook trapped in the downstream trap box were enumerated and released downstream of the weir, adult chinook were released upstream.

In prior years, salmon jumping against the top portion of the weir wings were able to spread pickets, get stuck, and die. To prevent this type of mortality for the 2003 trapping season, center picket braces were added to the first two sections of the weir wing out from the trap box on the east side and the first four weir wing sections out from the trap box on the west side. This

modification was successful and no fish were found dead in these areas. One female was found dead between pickets in a section without center braces. Braces were added to this section after the incident and no other fish were found wedged in the weir wings.

On a daily basis, all fish collected by the weir were individually netted out of the holding box and placed in a 30 gallon anesthetizing tub. The anesthetizing agent was Tricane Methane Sulfunate (MS-222) at a concentration of 90 mg/l. Once anesthetized, each fish was examined for fin clips, punches, and other external tags then, the following biological data was collected from each fish: sex, fork length, mid eye to hyperle length, scanned for PIT tags, coded wire tag (CWT), checked for Visual Implant Elastomer (VIE) tags, and a genetic sample collected. All adult salmon, those kept for broodstock or released above the weir, other than jacks were injected with erythromycin 200 at a rate of 10mg/kg as a prophylactic treatment for bacterial kidney disease (BKD). A sequentially numbered opercle tag was applied. Since Johnson Creek broodstock are held in the same holding ponds as the SFSR broodstock, it is necessary to differentially mark the Johnson Creek broodstock. A floy tag was applied for secondary identification. Neither the opercle tag nor the floy tag is retained 100% through the holding and spawning season so a plastic cable tie with an identification tab was also applied to the first 30 fish transported to the SFSR. Numbers corresponding to the floy tags were stamped on the cable tie tabs. Cable ties from pre-spawn mortalities at the SFSR were unreadable due to abrasion with the concrete and some cable ties had broken loose from fish. Efforts will be made to find a better secondary tag in the 2004 trapping season.

The first adults were captured on June 28th, two days after weir installation. The last adult was captured on September 11th and the trap was removed on September 15th. A total of 784 chinook were captured in 2003. Of these, 606 (77.3%) were natural origin, unmarked fish, 165 (21.0%) were CWT and/or VIE marked supplementation fish, and 13 (1.7%) were adipose fin clipped fish indicating they were strays from other hatchery programs (Table 1). During JCAPE M&E spawning ground carcass surveys upstream of the weir location, 16 (one female, 4 males, and eleven jacks) of the 504 fish sampled did not have opercle tags, staple marks, or DNA sample punch holes in the caudal fin. These fish either migrated upstream of the weir site prior to installation or got through or over the weir after installation. It is possible that some of the unmarked jacks recovered upstream of the weir during carcass samples passed through the weir undetected. Seven jacks that had been previously trapped, tagged, and released upstream were recaptured inside of the trap. There were no observations indicating that any adult fish were able to get through or over the weir or trap.

A total of 165 supplementation fish returned to Johnson Creek in 2003. These fish were comprised of 65 jacks (age 3) from the BY 2000 smolt release and 100 age 5 adults from the BY 1998 smolt release. These age 5 fish complete the adult returns for the BY 1998 supplementation release (unless chinook from this stock return as age six adults). Total BY 1998 smolt to adult survival to the weir was 0.922% or 0.623% when excluding age 3 fish (Appendix 1). No adults were collected in 1999. Therefore, no smolt releases were made in 2001 and there are no supplementation returns from that brood year.

Table 1: Adult Trapping Summary

	Natural Origin Adults	Supplementation Adults	Stray Adults	Total
Jacks	23	65	6	94
Males	247	28	4	279
Females	336	72	3	411
Total	606	165	13	784

In addition to adult chinook salmon, adult steelhead trout (*Oncorhynchus mykiss)*, bull trout (*Salvelinas confluentus*), cutthroat trout (*Oncorhynchus clarki*), and mountain whitefish (*Prosopium williamsoni*) were also captured. Two adult steelhead were captured in 2003, both females with fork lengths of 81 and 70cm. The steelhead were post spawn fish migrating down river and caught on the upstream side of the weir or in the downstream trap box, not in the main upstream trap box. Twenty-seven bull trout, 7 whitefish, and 1 cutthroat trout were captured and released upstream. Bull trout ranged from 37 to 60 cm fork length. Whitefish ranged from 29 to 40 cm fork length. The cutthroat trout was 36 cm fork length.

LENGTH AND AGE

Age class determination for Johnson Creek adult chinook have been adopted from average historical SFSR length at age data (Age 3 < 66 cm > Age 4 < 90 cm > Age 5). These categories were used to classify age of unmarked natural fish until length at age categories specific to Johnson Creek can be developed. Supplementation fish are marked or tagged in a manner that identifies their age and are classified accordingly. Using the length and age thresholds developed in the SFSR, the 2003 Johnson Creek run was comprised of 12% age 3, 25% age 4, and 63% age five (Table 2 and Figure 2).

Table 2: Age Class Summary

Age and Sex		Natural Adults	Supplementation Adults	Stray Adults	Total by Age and Sex	Total by Age
Age 3	Male	23	65	6	94	94
Age 4	Male	90	0	1	91	196
	Female	103	0	2	105	
Age 5	Male	157	28	3	188	494
	Female	233	72	1	306	
Total		606	165	13	784	784

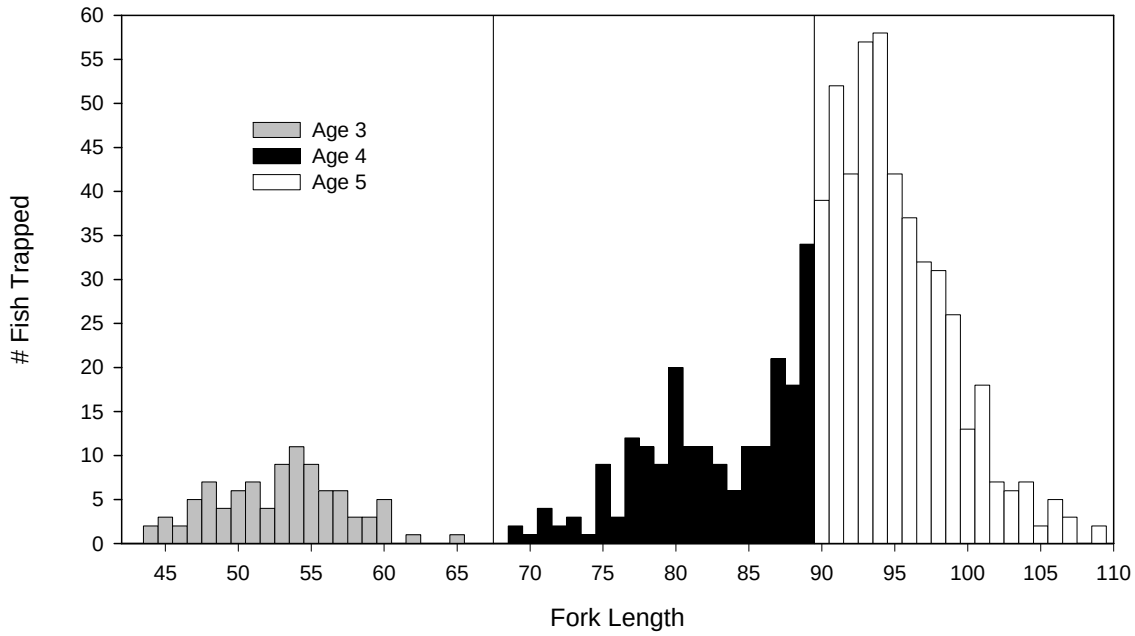

Figure 2: Johnson Creek Adult Chinook Length Frequency

Figure 3 illustrates the length frequency of known age supplementation fish that returned to Johnson Creek in 2003. Based on length at age categories used for general age classifications, it is evident that there is overlap of known age fish above or below the length threshold values. Thirteen percent (13 of 100) of the known age 5 supplementation fish were below the 90 cm fork length threshold for the general age 5 classification. These 13 fish would have been classified as age four if they had not been marked with CWT and/or VIE. In previous years, other known age fish have exhibited this same pattern. Attempts to use a single set of length at age threshold for a general age classification will continue to misclassify the actual age of some unmarked fish. Continued recalibration of the length at age threshold based on known age fish will help reduce this overlap. However, short of definitively aging each fish each year, length at age thresholds will be the best method available for classifying the age of unmarked fish during the entire run as a whole.

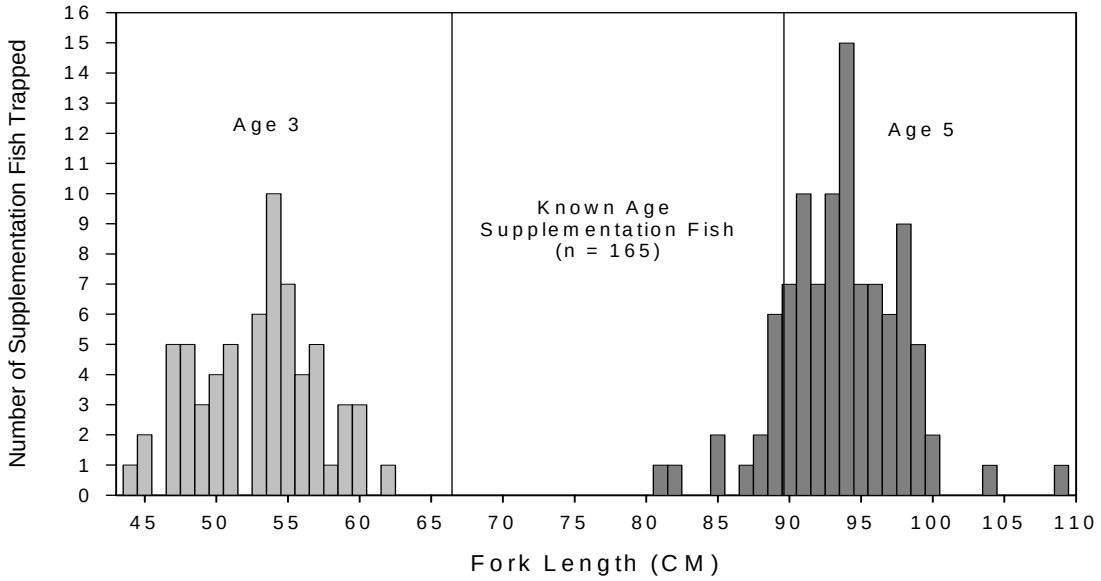

Figure 3: Johnson Creek Supplementation Adult Known Age Length Frequency

RUN TIMING

The first chinook was captured on June 28th and the last fish on September 11th. The 2003 run timing was bi-modal and is similar to what has been observed over the last several seasons (Figure 4). The first peak occurred in mid July, shortly after trapping began (Figure 4). The second peak occurred in mid to late August during spawning. The August peak is similar to what was observed in 1998, 2000, 2001, and 2002 (Gebhards and Daniel 2003; Hill et al 2004). July 9th was the largest day of trapping with 37 chinook trapped. August 7th is typically the beginning of spawning activity in Johnson Creek. Fifty-five percent of the run had passed through the trap by this date. As mentioned earlier, 16 fish were found without tags during spawning ground carcass surveys upstream of the weir location. It is possible that these fish migrated upstream prior to weir installation.

Figure 4 illustrates run timing, water temperature, and stream flow during the period that the adult trap was operated in Johnson Creek. Water temperature data is incomplete due to equipment malfunction. Figure 5 illustrates the run timing of natural fish versus supplementation fish into the Johnson Creek weir. In 2003, there appeared to be no difference in run timing other than the slight time lag of supplementation fish at the beginning of the run. Figure 6 illustrates the run timing of adult chinook (excluding jacks) and appears to be more similar than when jacks are included.

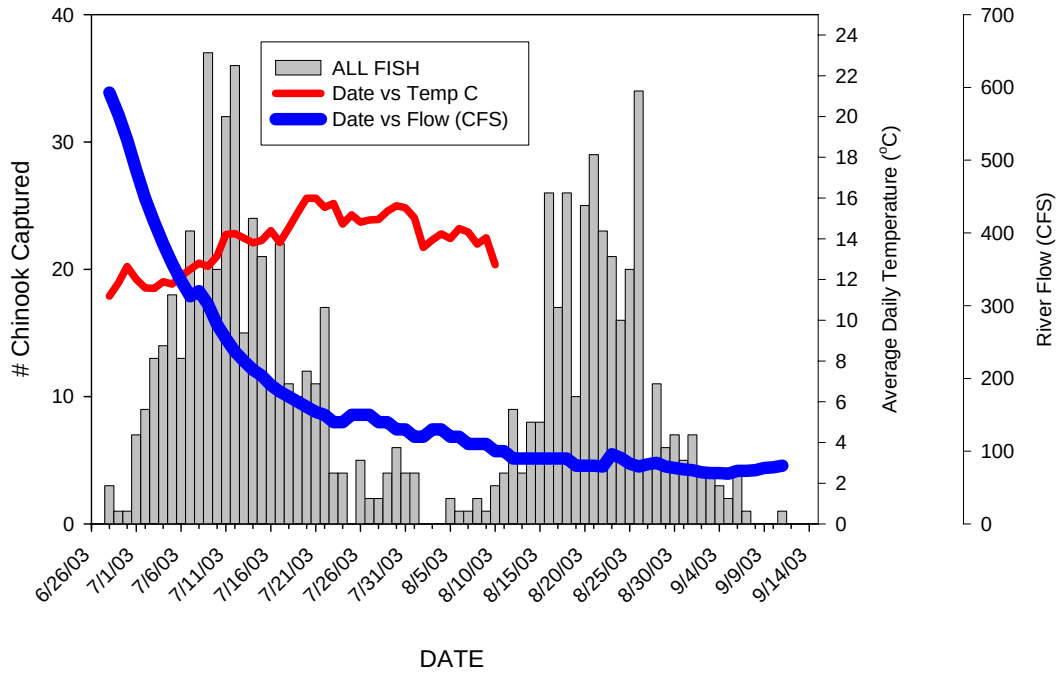

Figure 4: Run Timing, Water Temperature, and Stream Flow

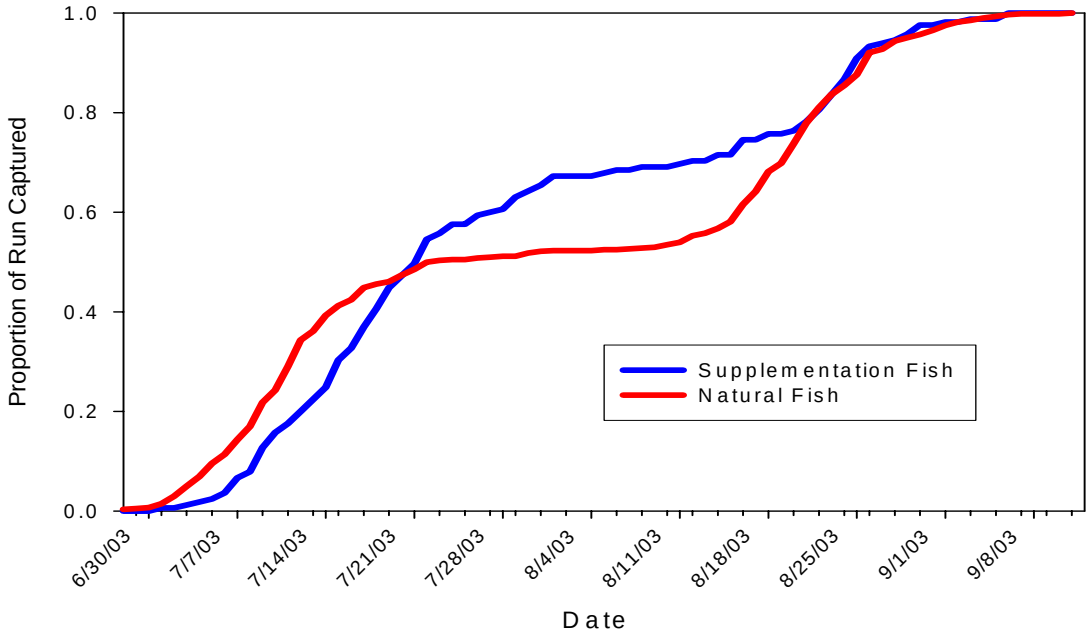

Figure 5: Run Timing of Natural and Supplementation Fish

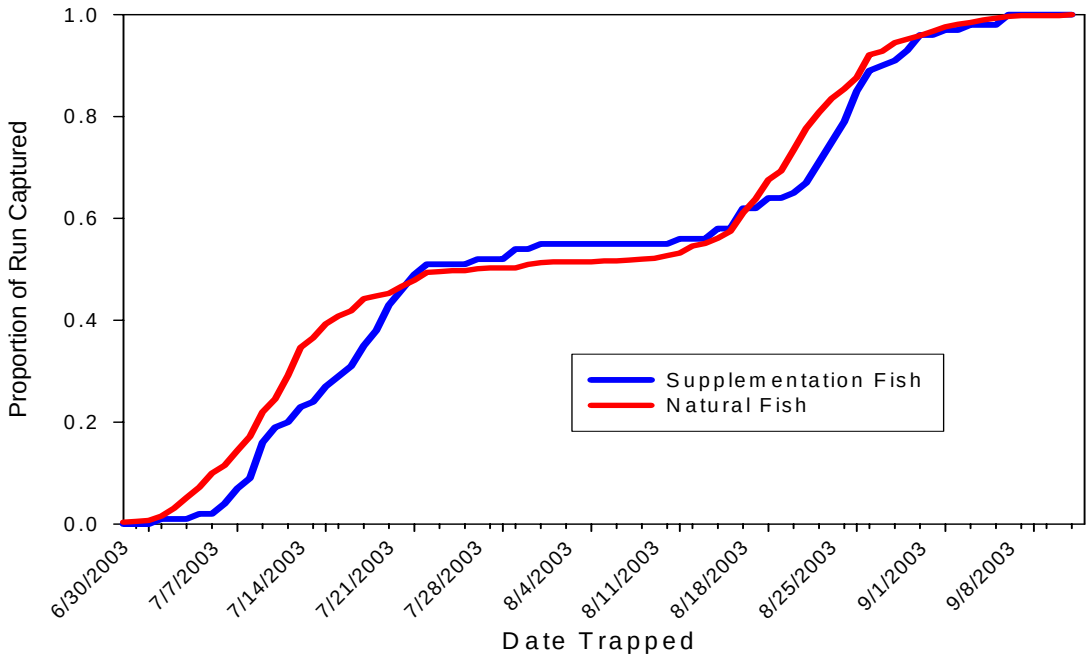

Figure 6: Run Timing of Natural and Supplementation Fish (No Jacks)

TAG AND MARK DETECTION

Radio tags, jaw tags, VIE tags, PIT tags, and CWT were detected at the Johnson Creek adult weir, along with adipose (AD) fin clips (Table 3). All AD clipped fish were hatchery fish released from other populations, most likely from the SFSR, and were not of Johnson Creek origin. CWT analysis from snouts collected from mortalities at the weir or carcasses from spawning ground surveys have not been completed as of this time to learn the actual origin of the CWT tagged fish.

Table 3: Summary of Tag and Mark Detections

	Radio Tag	PIT Tag	Jaw Tag	CWT Only	CWT and PIT Tag	VIE Only	VIE and PIT Tag	CWT and VIE	AD Only	AD and CWT
Age 3 (Jack)	0	9	0	11	0	3	1	50	2	4
Age 4 Male	0	7	0	0	0	0	0	0	1	0
Age 4 Female	2	6	0	0	0	0	0	0	1	1
Age 5 Male	0	21	0	10	2	9	0	7	3	0
Age 5 Female	2	24	2	22	2	3	1	44	0	1
Total	4	67	2	43	4	15	2	101	7	6

There were 67 PIT tags detected at the Johnson Creek adult weir in 2003 (Table 3) of these, 9 were age 3 jacks. Of the PIT tagged jacks, 3 were natural Johnson Creek fish, 5 were Johnson Creek supplementation fish, and 1 was from Rapid River Hatchery (RRH). The RRH fish was inadvertently classified as a Johnson Creek supplementation fish and released above the weir. Trap personnel either did not observe the missing adipose fin or, this fish was missed during the AD fin clipping process at the RRH prior to release. All of the age 4 PIT tagged fish were of natural origin. Seven of the 45 age 5 PIT tagged fish were from the Johnson Creek BY 1998 supplementation release.

In 2003, 494 age 5 adults returned to Johnson Creek. Of these age 5 returns, 100 were from the 1998 supplementation release; marks include 36 CWT only, 13 VIE only, and 51 had both CWT and VIE (Table 3). The remaining 394 age 5 adults were either natural origin or strays from other hatchery programs

Johnson Creek supplementation fish are all marked with CWT and VIE tags as parr. These fish are not AD clipped to minimize potential fishery impacts. Tag retention rates for CWT and VIE are checked during the PIT tagging process as smolts. In March 2000, 78,950 BY 1998 Johnson Creek smolts were released back into Johnson Creek. Based on pre-release CWT and VIE tag loss rates, 78,839 of these fish were tagged with either CWT, VIE or both (CWT loss rate = 2.01%, VIE loss rate = 5.46%, loss rate of both CWT and VIE = 0.14%) (Table 4). Therefore, the potential exists for some returning supplementation fish to be classified as natural fish.

Post release CWT and VIE tag loss rates have increased each year of the adult returns for the BY 1998 smolts (Table 4). A supplementation adult that is detected with only CWT has shed or lost the VIE tag and, an adult that is detected with a VIE tag but no CWT has lost the CWT. The product of the two tag loss rates estimates the probability of loosing both tags. Calculating the number of supplementation fish that have shed both tags and had been misclassified as natural fish with annual tag loss rates or the total BY 1998 tag loss rates estimates 17 fish being misclassified (Table 4). The high post release tag loss may have been a result of personnel not detecting either CWT or VIE tags while inspecting adults at the fish trap. However, personnel made an extra effort to detect a secondary tag once either a CWT or VIE tag was detected. It is likely that VIE tags may have become overgrown with tissue, making them more difficult to detect than the CWT.

Table 4: Tag Detections and Tag Loss BY 1998 Adult Returns

Age	Return Year	Number Of Supplementation Adults Returning			Total Supplementation Adult Return	Tag Loss		Calculated Percent Tag Loss of Both CWT and VIE	Calculated Number of Fish Misclassified as Natural
		CWT Only	VIE Only	CWT and VIE		CWT	VIE		
Smolt	2000[1]	N/A	N/A	N/A	N/A	2.01%[2]	5.46%[2]	0.14%[2]	N/A
3	2001	55	12	169	236	5.1%	23.3%	1.19%	2.8
4	2002	121	33	238	392	8.4%	30.9%	2.6%	10.2
5	2003	36	13	51	100	13.0%	36.0%	4.68%	4.68
Total	N/A	212	58	458	728	7.97%	29.12%	2.32	17

1- Release Year

2- Actual number observed during PIT tagging.

Ninety-four age 3 BY 2000 jacks returned to Johnson Creek in 2003. Of these age 3 returns, 11 were CWT only, four were VIE only, and 50 had both CWT and VIE. Based on these tag recoveries, 65 of the age 3 returns were from the BY 2000 supplementation release. The trend of increasing tag loss over time was also observed in the 2003 age 3 jacks returning from BY 2000. The pre-release tag loss of BY 2000 was 3.47% for CWT and 1.91% for VIE tags. Tag loss rates for CWT and VIE tags in 2003 for the age 3 returning jacks from BY 2000 was 6.2% and 16.9% respectively.

FISH DISPOSITION AND ADULT HOLDING

Adult chinook captured at Johnson Creek were either: 1) released upstream for natural spawning; 2) selected as broodstock and transported to the SFSR (natural fish only); or 3) euthanized and placed into Johnson Creek for nutrient enhancement (stray AD fin clipped fish only) (Table 5). AD clipped fish were euthanized rather than transported back to the SFSR because of an over abundance of Ad fin clipped fish at the SFSR facility.

In 2001 and 2002, NOAA Fisheries disallowed the release of any AD clipped hatchery stray salmon upstream of the Johnson Creek weir because of the potentially high number of salmon straying into Johnson Creek from the SFSR. This continued for the 2003 trapping season and no AD clipped hatchery fish were released upstream of the weir in 2003. Stray hatchery fish trapped at the Johnson Creek weir were euthanized and placed in Johnson Creek for marine nutrient enrichment. Prior to this directive, AD clipped fish trapped in Johnson Creek could either be released upstream to spawn naturally or be kept for broodstock as outlined in the JCAPE ESA section 10 permit application (Lothrop 2000).

Adults collected for broodstock were transported to the SFSR facility in a 400 gallon aluminum transport tank mounted on a one-ton flatbed truck and equipped with an aerator and oxygen supply. The tank was filled with river water prior to trap work up and supplied with oxygen at a rate of approximately 8 liters per minute. Fish were then transported about 35 miles (1.25 hour) to the SFSR facility. The fish were then netted out of the tank and placed into the appropriate male or female holding pond at the SFSR. At first spawning sort, Johnson Creek males were moved to a 16-foot diameter, 5-foot deep circular tank and remained there through the spawning season. Any new Johnson Creek males brought to the SFSR are then placed in the circular tank to keep stocks separated. Johnson Creek females remained in the female SFSR holding pond.

Over the course of the run, 3 jacks, 35 males, and 41 females (natural fish only) were retained for broodstock and transported to the SFSR (Table 5).

Table 5: Fish Disposition

	Released Upstream	Transported to SFSR	Trap Mortalities	Euthanized	Total Trapped
Johnson Creek Jack	85	3	0	0	88
Johnson Creek Male	240	35	0	0	275
Johnson Creek Female	366	41	1	0	408
Fin Clipped Jack	0	0	0	6	6
Fin Clipped Male	0	0	0	4	4
Fin Clipped Female	0	0	0	3	3
Total	691	79	1	13	784

The JCAPE project attempts to retain broodstock that represent the run in general. The run estimate for 2003 was 750 and broodstock collection was set at one of every 10 natural origin fish. The retention of broodstock for 2003 closely matched the run of fish into Johnson Creek (Figure 7). Overall, 13% of the natural fish returning to Johnson Creek were retained for broodstock.

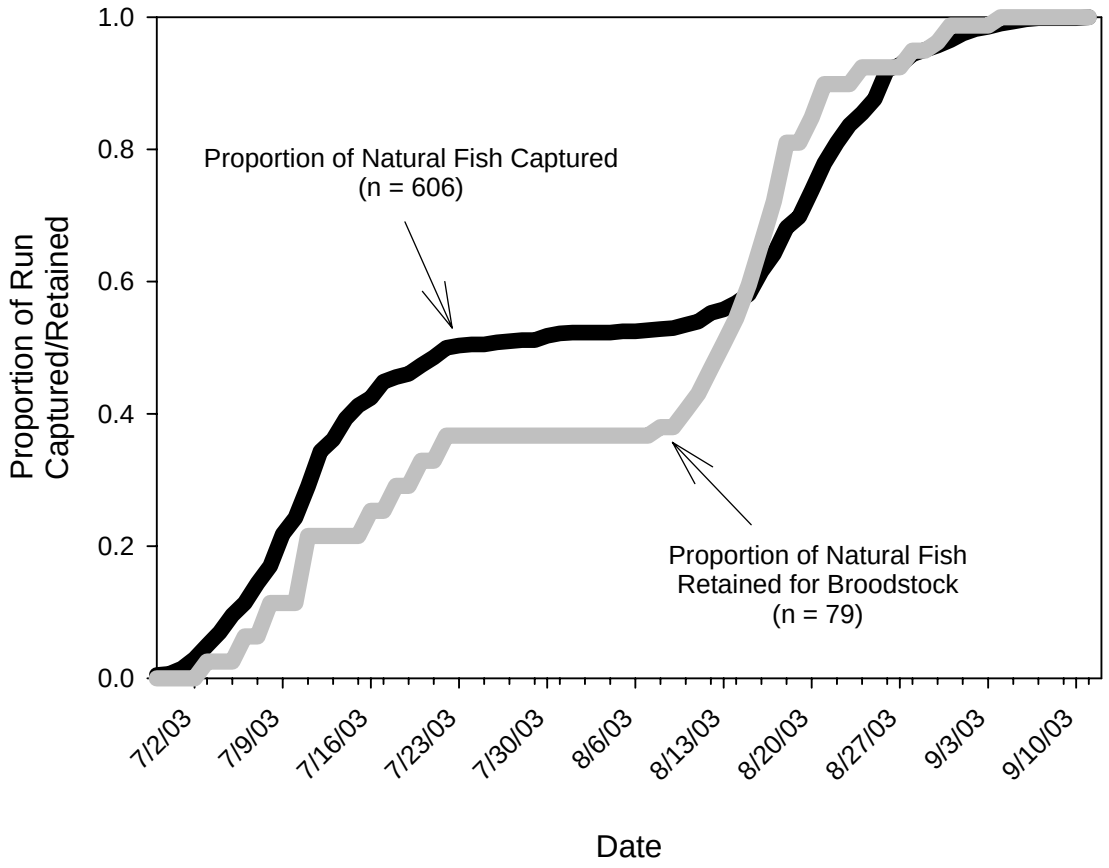

Figure 7: Natural Fish Retained in Proportion to Natural Fish Trapped

INJURIES AND PRE-SPAWNING MORTALITY

The picket braces added to the weir were successful in preventing any mortalities in those areas. However, one age five female wedged herself between pickets and died in a section of the weir without braces. Picket braces were added to this section following this incident. The plywood trap box cover was replaced with a nylon cloth cover that fits better and reduces potential injury to the fish.

The old shade and jump screen covering the circular tank at the SFSR facility was replaced in 2003. The new cover looks similar to a teepee with a metal conduit frame and nylon fabric cover. The fabric is suspended from the frame and is attached around the upper perimeter of the tank. This cover worked very well this season and no fish were able to jump out.

All salmon transported to the SFSR that did not contribute to the spawn were considered a pre-spawn mortality. This is a change from prior years when males that died after two weeks of the first spawn date were not considered pre-spawn mortalities regardless of contributing to the spawn. In 2003, the Johnson Creek female pre-spawn mortality was 39.0%, male pre-spawn mortality was 25.7% and 33.3% for jacks (Table 6).

This compares to the 2003 SFSR female pre-spawn mortality of 45.9% and 17.6% for the males including jacks (Table 6). The ten-year average pre-spawn mortality at the SFSR is 10.9% for males and 14.5% for females (MFH 1991 - 2002). Johnson Creek pre-spawn mortality differs from the SFSR pre-spawn mortality because of the cumulative stress effects of the transport on the Johnson Creek fish. SFSR male pre-spawn mortality does not include males that die after two weeks of the first spawn date. Table 7 lists the Johnson Creek pre-spawn mortality from the previous four years of broodstock collection.

Table 6: 2003 Johnson Creek Pre-Spawn Mortality

	Johnson Creek Pre-Spawn Mortality	Total Transported to SFSR	% Johnson Creek Pre-Spawn Mortality	SFSR Pre-Spawn Mortality
Jacks	1	3	33.3%	
Males	9	35	25.7%	17.6% [1]
Females	16	41	39.0%	45.9%
Total	26	79	32.9%	

1 – Includes Jack pre-spawn mortality

Table 7: Historical Johnson Creek Pre-Spawn Mortality

Brood Year	Jacks		Males		Females		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1998	0	0	3	15.0	2	5.9	5	9.1
2000	2	6.3	1	4.0	0	0	3	4.1
2001	7	46.7	33	39.8	22	43.1	62	41.6
2002	0	0	5	9.4	8	19.1	13	13.4
2003	1	33.3	9	25.7	16	39.0	26	32.9
Average		17.3		18.8		21.4		20.2

SPAWNING

Spawning at the SFSR normally occurred twice a week, Tuesdays and Fridays. The first spawning sort occurred on August 12th when every fish was checked for sex and females are checked for ripeness. Johnson Creek males were transferred from the SFSR male holding pond to the circular holding tank during this sort to streamline the spawning process and reduce handling stress.

A total of 25 Johnson Creek females were spawned this year on seven spawn days or egg lots (Table 8). Eggs from 21 individual females were fertilized with a single male and, four females were spawned with two males each. Twenty-eight different males (two of these were jacks) were spawned with the 25 females, only one male was spawned with two females (Table 8). The last spawn day was September 9th. After fertilization, eggs from individual females were water hardened, disinfected, and transported in separate egg tubes to the McCall Fish Hatchery. Disease samples were taken from each female as they were spawned. All carcasses from spawned out fish or pre-spawn mortalities were returned to Johnson Creek for nutrient enhancement. Fifteen live males were returned to Johnson Creek after being used as broodstock at the SFSR. These males were then released in an attempt to have them spawn with other fish in Johnson Creek.

Table 8: Broodyear 2003 Spawning and Egg Incubation

Date	Lot	Female ID #	Male ID #	Male ID #	# Green Eggs	# Eyed Eggs	% Eye-Up	BKD ELISA Optical Density
8/12/03		3348	3091	3002	3144	2241	71.3	0.072
8/12/03	1	3346	2963		4479	3687	82.3	0.094
8/12/03		3345	2926		4476	3604	80.5	0.093
8/15/03		3340	3335		4750	2866	60.3	0.067
8/15/03	2	3365	3355		6096	5193	85.2	0.096
8/15/03		3356	3353		2656	1491	56.1	0.068
8/19/03		3363	3337		5387	4942	91.7	0.095
8/19/03		3382	3357		3924	3140	80.0	0.082
8/19/03		3351	2999		6753	6067	89.8	0.080
8/19/03		3414	3352		6164	6027	97.8	0.092
8/19/03	3	3425	3416		5749	5263	91.5	0.096
8/19/03		3372	3339		4058	2370	58.4	0.082
8/19/03		3423	3366		5120	3834	47.9	0.072
8/19/03		3410	3398	3415(J)[1]	4907	4055	82.6	0.098
8/19/03		3378	3364		5534	5313	96.0	0.076
8/19/03		3399	3373		6063	3768	62.1	0.064
8/22/03		3479	3401		6002	5158	85.9	0.107
8/22/03	4	3476	3453		5911	5129	86.8	0.077
8/22/03		3420	3450		5148	3839	74.6	0.072
8/26/03	5	3451	3439(J)[1]	3235	5398	4366	80.9	0.109
8/29/03		3623	3480		6651	6220	93.5	0.089
8/29/03	6	3550	3484		4421	3507	79.3	0.085
8/29/03		3627	3559		5191	3976	76.6	0.067
8/29/03		2966	3235(PS)[2]		3383	1778	52.6	0.085
9/5/03	7	3646	3664	3637	5535	4126	74.5	0.073
Total		25			126,900	101,960		
Average					5076		80.4	

1 - J = Jack
2 - PS = Previously spawned

PATHOLOGY RESULTS

The IDFG pathology department samples Johnson Creek adult female chinook used as broodstock to test for bacterial kidney disease (BKD), infectious hematopoietic necrosis (IHN), infectious pancreatic necrosis (IPN), and whirling disease (WHD). Two of the twenty-five females sampled tested positive for BKD, both of these had low optical densities (greater than 0.1 and less than 0.25) enzyme-linked immunosorbent assay (ELISA) BKD values (Table 8). Their optical densities were 0.107 and 0.109. Only eggs from females with high optical densities (greater than 0.25) ELISA values would be culled in 2003. No eggs from Johnson Creek females were culled this year. All other tests were negative for the other pathogens in which tests were conducted.

Prior to 1998, no disease history had been established for the Johnson Creek natural spawning population. Positive BKD results from samples collected in 1998, 2000, 2001, and 2002 indicate an existing level of this disease in Johnson Creek (Table 9)(Gebhards and Daniel 2003; Hill et al. 2004). ELISA reagent batches have different sensitivities that determine the threshold levels between negative, low, and high BKD. A different reagent batch was used in 1998 (high BKD > 0.8) than 2000, 2001, and 2003 (high BKD > 0.25) and 2002 (high BKD > 0.12).

Table 9: BKD Testing Results from Prior Years

Year	Number Tested	Percent Positive	Percent High Positive
1998	32	47%	13%
2000	43	58%	7%
2001	29	52%	7%
2002	34	9%	6%
2003	25	8%	0%

EGG INCUBATION AND EYE-UP

Eggs from each female were incubated separately so that they could be culled if BKD levels of the parent female were high. None of the Johnson Creek females tested high for BKD. The 25 females spawned produced 126,900 green eggs that eyed-up at an average of 80.4% for a total of 101,960 eyed eggs (Table 7). Egg eye-up rate for SFSR stock in 2003 was 83.1%. Records from broodyears 1993 – 2002 for the MFH show green-egg to eyed-egg survival rates between 74.5% and 93.4% with an average of 86.1%. Green-egg to eye-egg survival rates for the JCAPE program from 1998 – 2003 have ranged from 62.0% to 86.0% with an average of 77.9% (Table 10). Eye-up rates for the SFSR program for the same period of time have ranged from 74.5% to 87.3% with an average of 82.4%.

Table 10: JCAPE Eye-Up Rates 1998 – 2003

Brood Year	JCAPE Eye-up	SFSR Eye-up
1998	62.0%	80.8%
1999	No eggs taken	83.7%
2000	86.0%	85.2%
2001	75.4%	74.5%
2002	85.9%	87.3%
2003	80.4%	83.1%
Average	77.9%	82.4%

CRYOPRESERVATION

Personnel from the NPT cryopreservation project (BPA project number: 199703800) collected gamete samples from 57 Johnson Creek males in 2003. Thirty-seven (37) males were sampled from Johnson Creek, 17 at the weir and 20 from the stream. A total of 20 Johnson Creek broodstock males at the SFSR were also sampled.

CONCLUSIONS

The fifth season of JCAPE adult trapping went well but not without challenges. Improvements in field operations in 2003 were made because of experience gained in preceding years. These include:

- Center picket braces were added to the weir sections where fish typically jump to keep fish from becoming wedged between pickets.
- All areas inside the trap box that could cause injury to jumping fish were covered with pipe insulation to minimize effects.
- Improved shade and jump screen for the trap box.
- Improved shade and jump screen for the circular tank.
- Fixed placement pickets for several areas of the trap box.

Minor improvements that need to be addressed for the 2004 field season include:

- More secure secondary identification tag for adults.
- Replace trap pickets as original pickets become weak or bent.
- Backup electrical power source for the adult circular tank water pump at the SFSR.
- Egg tube replacement

There are many more improvements that can be made to add to the continued success of the JCAPE project. Additional facilities are necessary to conduct field operations properly.

- A permanent trapping facility on Johnson Creek would eliminate many of the problems encountered with the current trapping equipment. Trapping would be more efficient, more fish friendly and easier for NPT personnel to install and operate.
- A permanent holding facility at Johnson Creek would eliminate the need for fish transport thus greatly reducing the amount of stress placed on fish retained for broodstock. Permanent holding would also eliminate problems encountered with temporary holding facilities at the SFSR facility. Johnson Creek females would not have to cohabitate with SFSR females in a foreign water source. Males would not have the added stress of moving from fish truck to raceway to circular holding tank. Many of the dangers of using pumps, pipes, and hoses for providing a temporary water source would be eliminated.

Support and the approval of the agencies governing the activities of JCAPE will continue to be solicited by JCAPE and NPT-DFRM administration. Adaptive management practices will continue to be used to improve the JCAPE project and increase its effectiveness restoring chinook salmon populations in Johnson Creek.

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Appendix A: JCAPE Supplementation Releases and Returns 1998 – 2003

Brood Year [1]	Females Spawned[2]	Males Spawned[2]	Eggs Taken	Eggs Per Female	Eggs Culled	Number Released	% Egg To Release Survival[3]	Release Year	Males Trapped			Females Trapped			Total BY Return	% Return (SAR)	Total Adult BY Return	% Adult Return (SAR)
									Age 3	Age 4	Age 5	Age 3	Age 4	Age 5				
1998	32	17	155,870	4,871	20,477	78,950	58.3	2000	236	233	28	0	159	72	728	0.922	492	0.623
2000	16	25	65,060	4,066	0	57,392	88.2	2002	65	-	-	0	-	-	65[4]	0.113[4]	N/A[4]	0[4]
2001	28	50	115,848	4,119	8,733	73,000	68.2	2003										
2002	34	44	166,122	4,885	9,601	14,996[5] 2,388[6] 112,870[7]	96 96.9 83.2	2002 2003 2004										
2003	25	28	126,900	5,076	0													

1 – No Broodstock were collected in 1999, so no supplementation fish will be documented for that brood year.
2 – All male and female broodstock were from wild/natural origin, unless otherwise specified in the report text.
3 – The number of eggs culled is subtracted from number of eggs taken in calculating egg to smolt survival.
4 – Incomplete due to brood year not fully returned.
5 – Eyed egg out-plant on October 22, 2002 of 14,996 eyed eggs.
6 – Fall Pre-smolt release on October 28 and 29, 2003.
7 – Brood year 2002 smolt release on March 15 through 18, 2004.